

202

# Quantitative Research

## *Agenda*

Announcements

Statistics review

# Announcements

---

Need to put together a 'notebook' that includes:

- Lecture slides/anything posted on class website
- Labs
- Can be a folder on your computer or hard copy
- Will count toward 5% of your lab grade

# Types of Analyses

---

- ✓ Descriptive
- ✓ Multiple variables within a single group
- ✓ Group Differences (Chapter 13)

# Statistics

---

- ✓ The purpose of **descriptive** statistics is to simplify the organization and presentation of data
  - ✓ Central Tendency
  - ✓ Variability
  - ✓ Distribution or shape of the data
- ✓ The purpose of **inferential** statistics is to make inferences about a population based on a sample

You *describe* your sample and *infer* what it says about the population

# Descriptive Statistics and Levels of Measurement

---

## Nominal

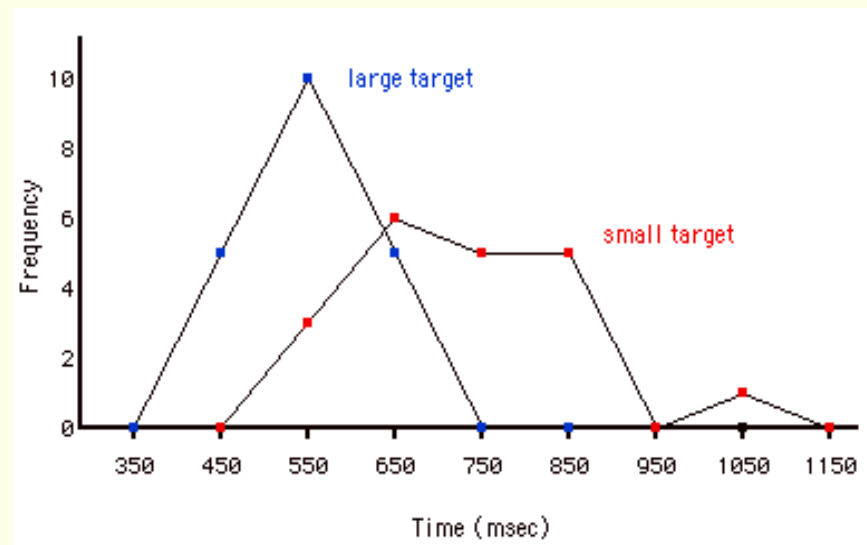
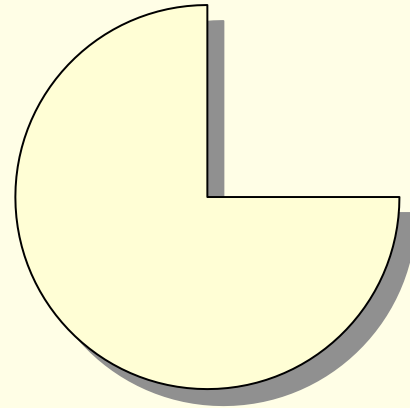
- ✓ Percentages
- ✓ Counts
- ✓ Mode
- ✓ Bar Graph
- ✓ Chi-Square ( $\chi^2$ )

## Interval/ratio

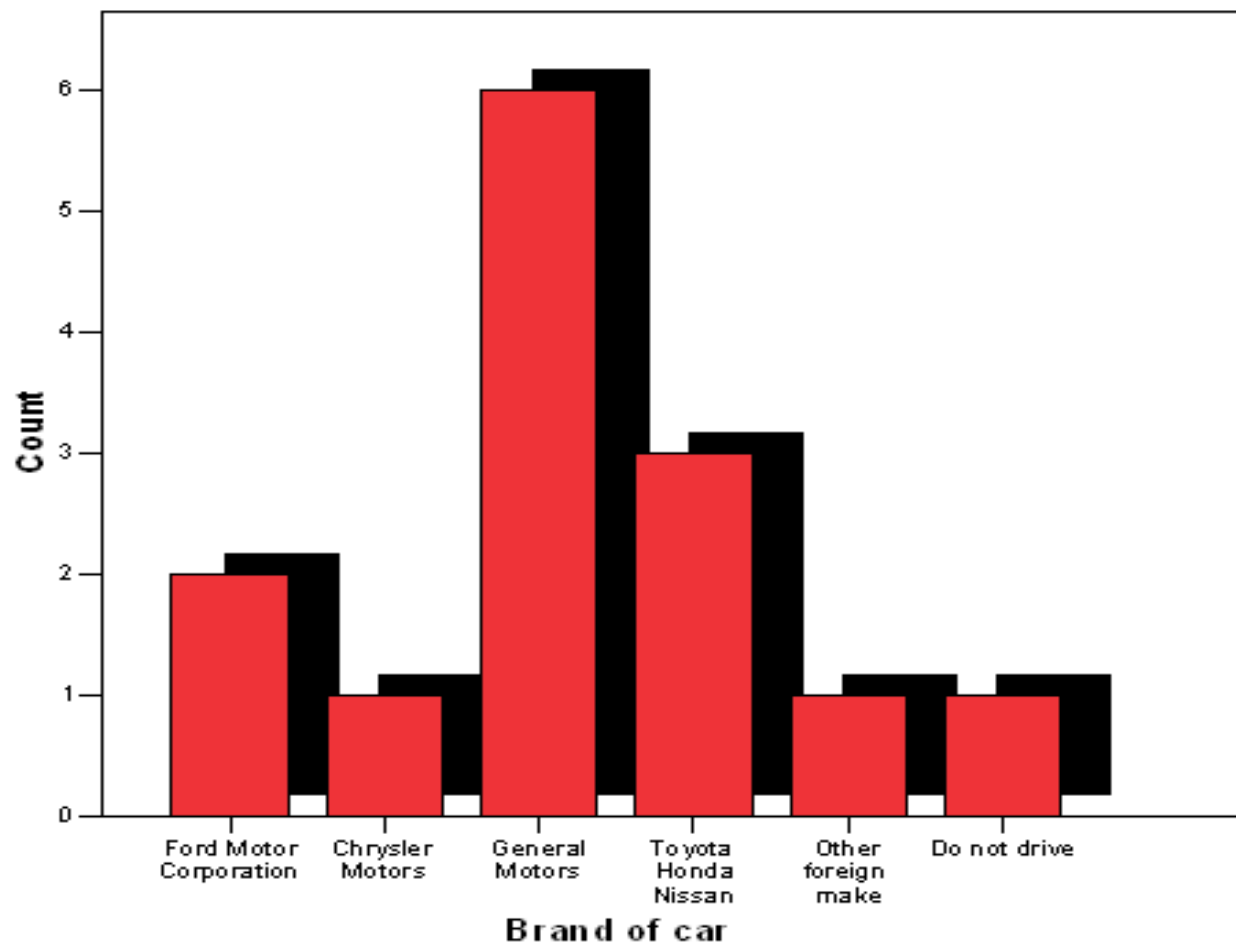
- ✓ Mean
- ✓ Median
- ✓ Mode
- ✓ Variability (SD)
- ✓ Frequency distributions (tables and graphs)

# Frequency Distributions

- ✓ Pie charts
- ✓ Bar graphs
- ✓ Frequency polygons
- ✓ Histograms



# Bar Graph– Nominal Data



# Chi-Square test of independence

## Chi-Square ( $\chi^2$ ) Test (Usually done with two nominal variables)

### Contingency Tables

	Men	Women
Dem.		
Repub.		

2 X 2 most common, but doesn't have to be


To calculate a p value,  
you need degrees of  
freedom.

$$Df = (r-1) * (c-1)$$



# Descriptive Statistics

---

- ✓ Central Tendency

- ✓ Average annual rainfall in California

- ✓ Mean

- ✓ Median

- ✓ Mode

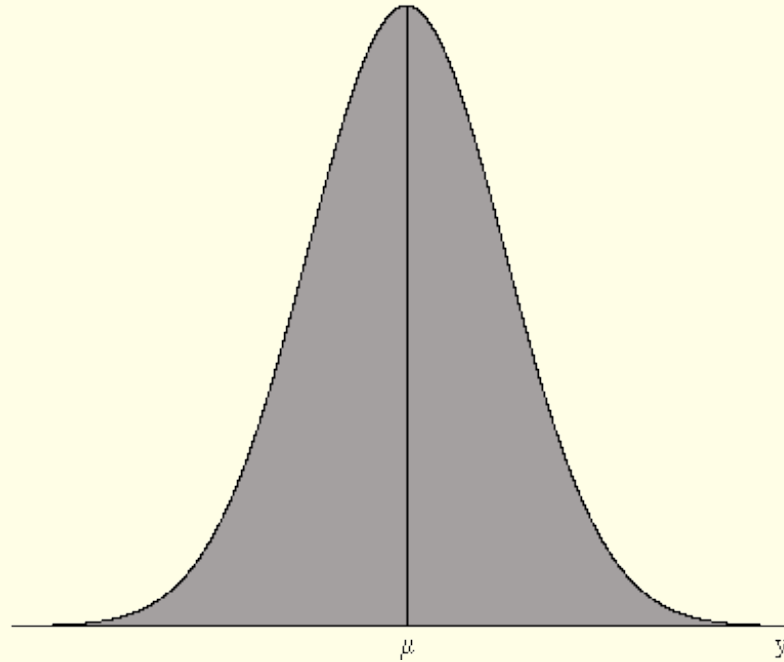
- ✓ Variability

- ✓ Range

- ✓ Percentiles

- ✓ Standard Deviation

# Normal Distribution

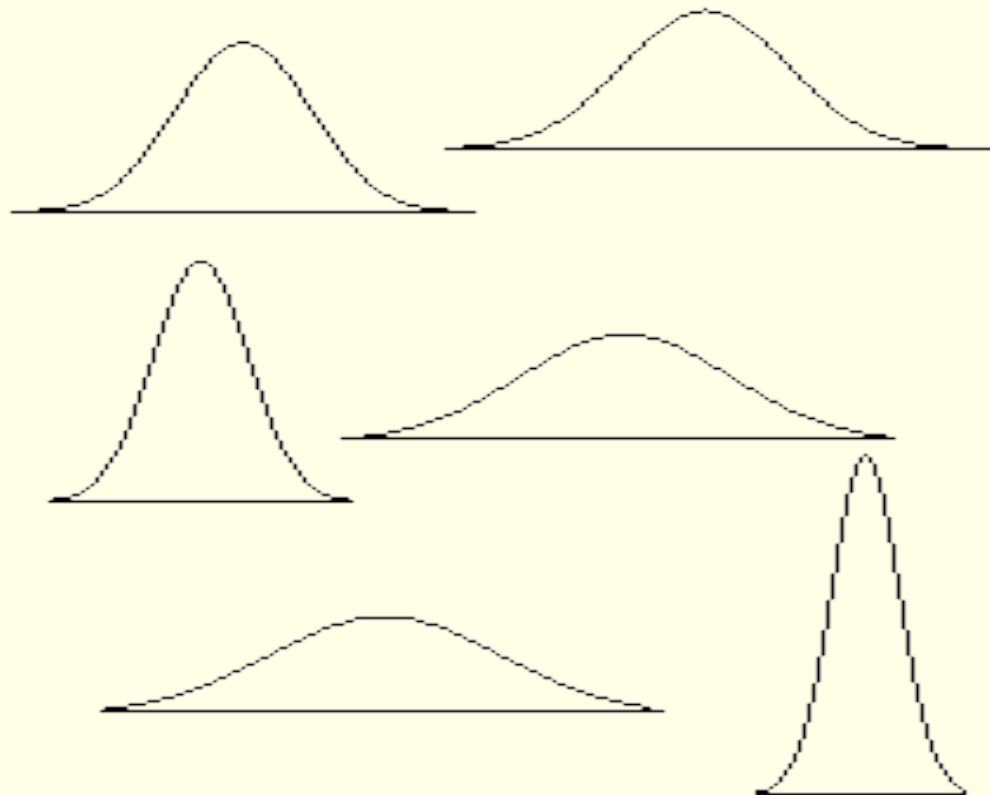


## Characteristics

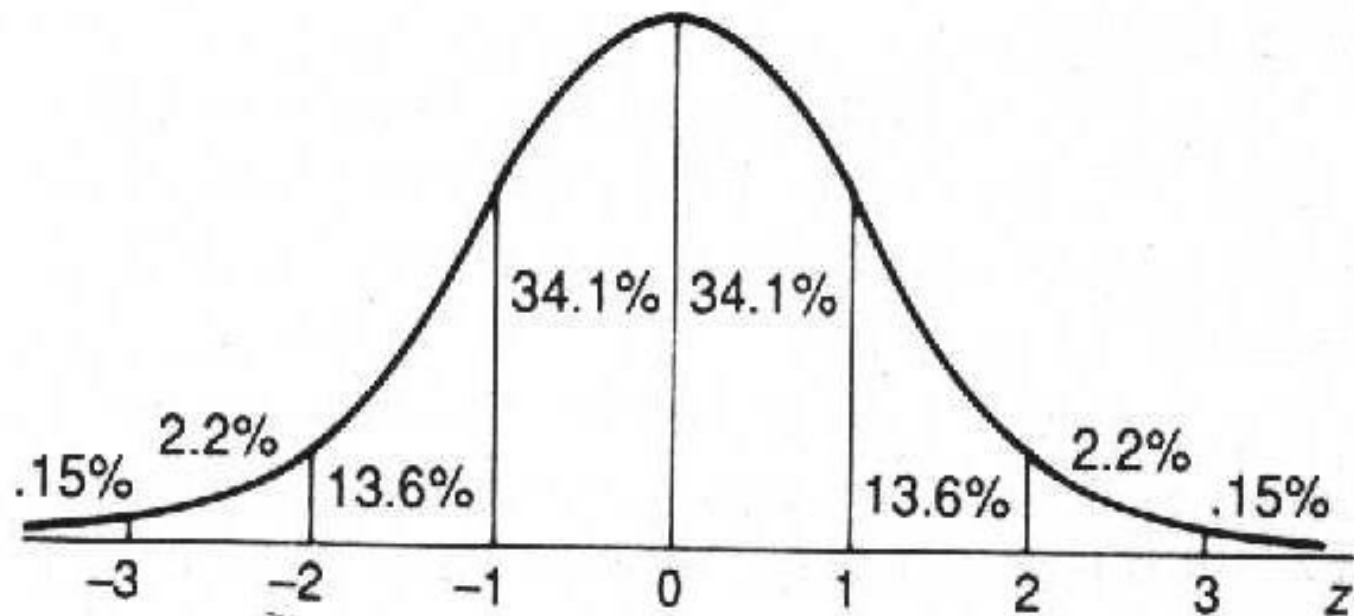
1. The graph has a single peak at the center, this peak occurs at (the mean).
2. The graph is symmetrical about (the mean).
4. The area under the graph is equal to 1.

# Normal Distribution

---



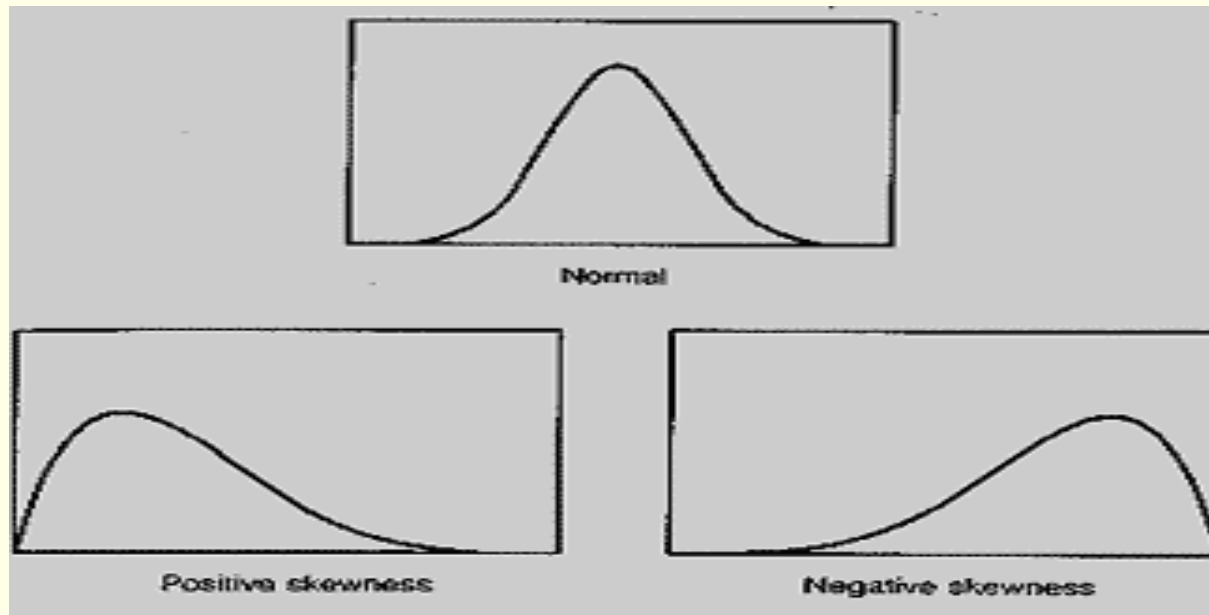
# Normal Distribution



**Figure 5-6.** Standard normal ( $z$ ) distribution.

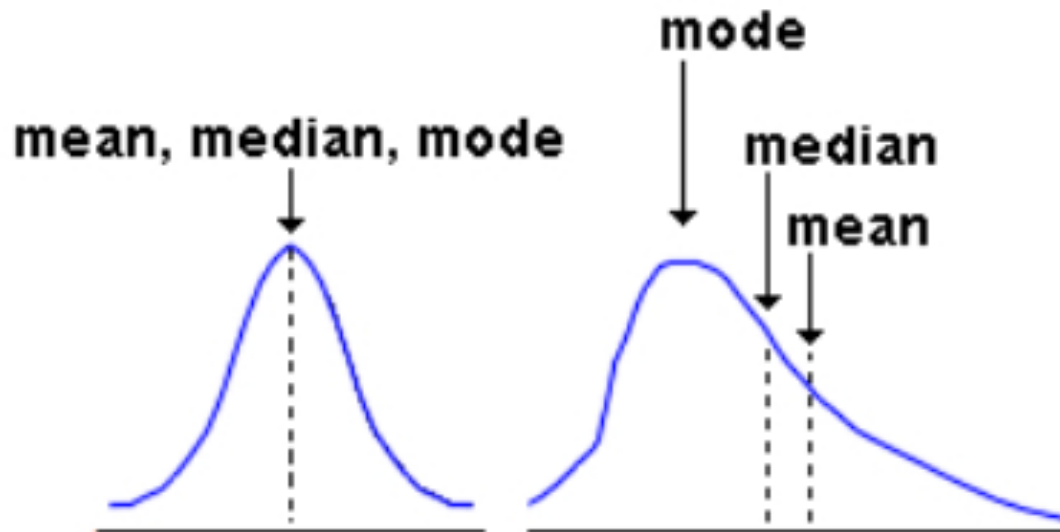
# Not so normal distribution

---



# Not so normal distribution con't. (or why do we care?)

## Measures of Central Tendency



# Standard deviation revisited

---

- ✓ Variance is SD squared
- ✓ Standard error is  $SD/\sqrt{n}$

# Descriptive Statistics--tips

---

- ✓ If data are nominal, use count, proportion, percent
- ✓ Reaction time data is usually median rather than mean
- ✓ Might use median to control for outliers



# Normal Distribution

---

- ✓ Sampling distribution of the mean
  - ✓ Statisticians assume normal distribution and infinite set of samples
  - ✓ Compare experimental samples to this fictitious perfect distribution

# T-test: comparing means

---

Interval and ratio data

Three main types of t-test:

1. One sample t-test

- Compare one mean to chance level

2. Independent samples t-test

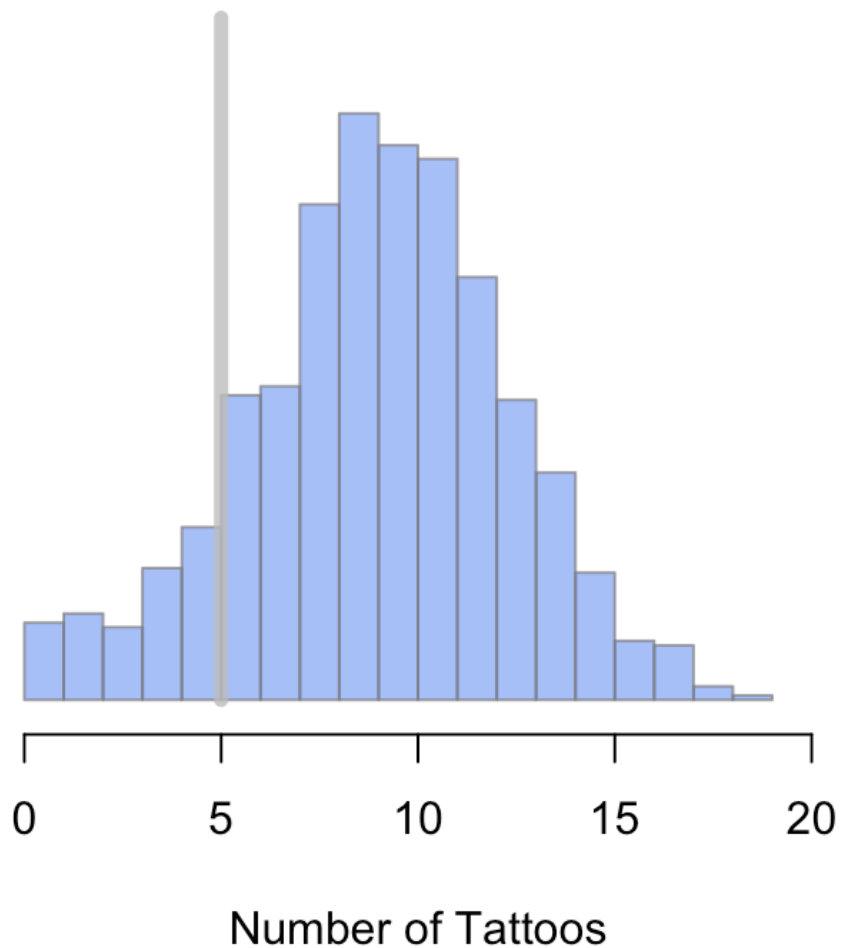
- Compare means of two *separate* groups (between group comparison)

3. Paired samples t-test

- Compare means within the same group (within group comparison)

# 1-Sample t-test

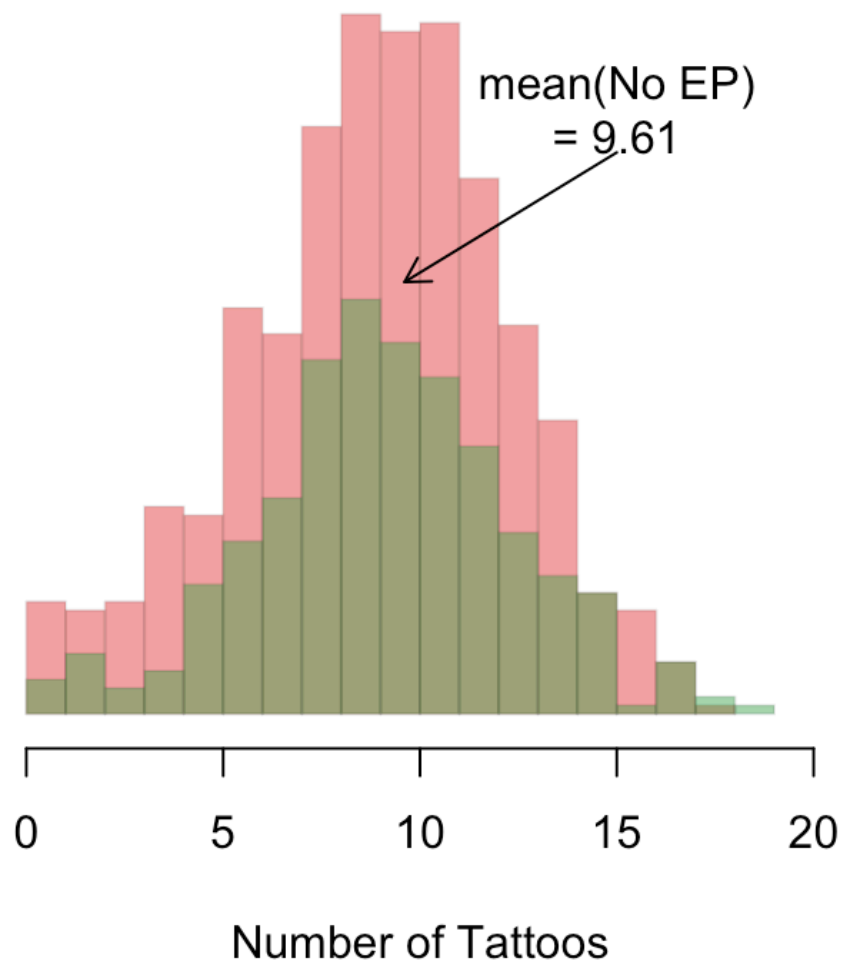
Null Hypothesis  
Mean = 5



# 2-Sample t-test

mean(EP)  
= 9.34

mean(No EP)  
= 9.61



# Types of Analyses

---

- ✓ Descriptive
  - ✓ The purpose of descriptive statistics is to simplify the organization and presentation of data
- ✓ Group differences and Multiple variables within a single group
  - ✓ The purpose of inferential statistics is to use the limited data from a sample as the basis for making general conclusions about the population

# Multiple Variables w/in a single group

---

- ✓ Two variables—Correlation
  - ✓ Direction
  - ✓ Degree
  - ✓ Shape (linear vs. other)
- ✓ Pearson Product Moment
  - ✓  $r = .31, n = 50, p < .05$
  - ✓ Bidirectional (iv ↔ dv)
- ✓ Restriction of Range

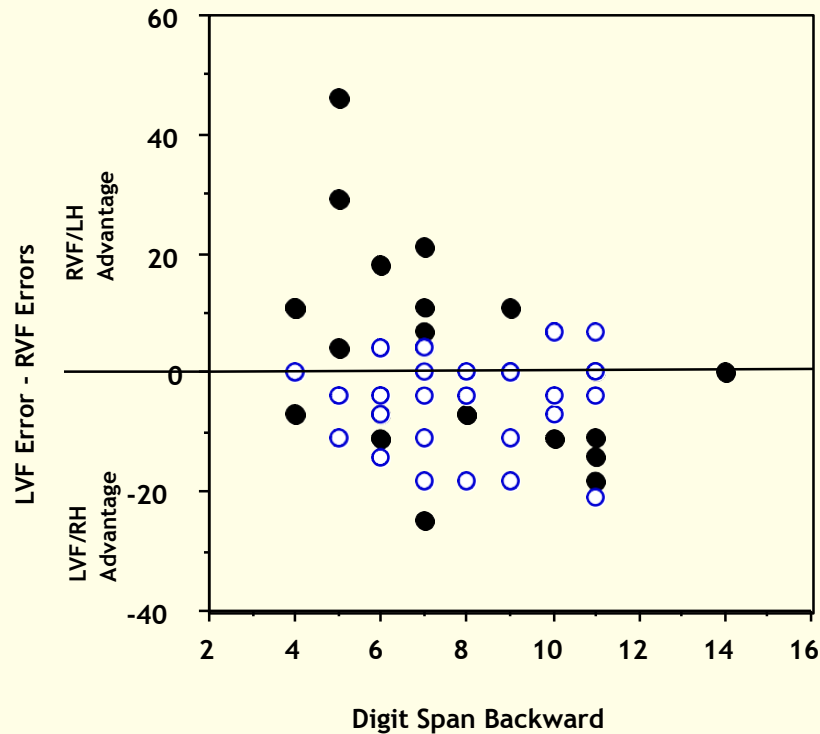
# Effect size

---

- ✓ The strength of association between variables
- ✓ Pearson  $r$  correlation coefficient
- ✓ Effect sizes
  - ✓ Small ~ .15
  - ✓ Medium ~ .30
  - ✓ Large ~ .40
- ✓  $r^2$  or percent of shared variance between two variables

# Multiple Variables w/in a single group

## Scatterplots



# Multiple Variables w/in a single group

---

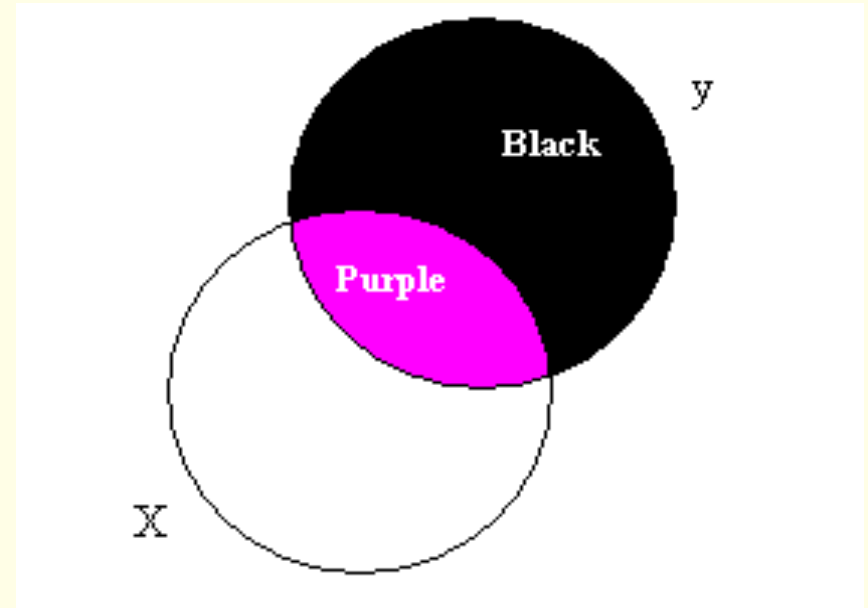
- ✓ 2 or more variables
  - ✓ Correlations—two variables
  - ✓ Correlations—more than two variables
    - ✓ Partial correlations
    - ✓ Part correlations
  - ✓ Regression



# Two Variables w/in a single group

---

- ✓ 2 or more variables
  - ✓ Correlations—two variables

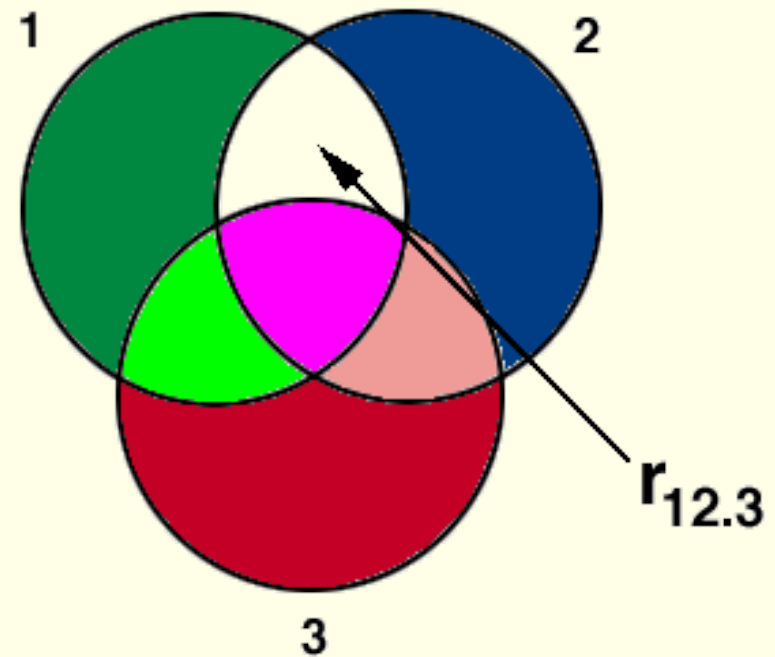


# Three or more Variables w/in a single group

---

✓ Correlations—more than two variables

✓ Partial correlations



# Multiple Variables w/in a single group

## Multiple correlation

---

- ✓ Simple Regression

- ✓  $Y = a + bX$

- ✓ where  $a$  = intercept;  $b$  = slope

- ✓ Multiple Regression

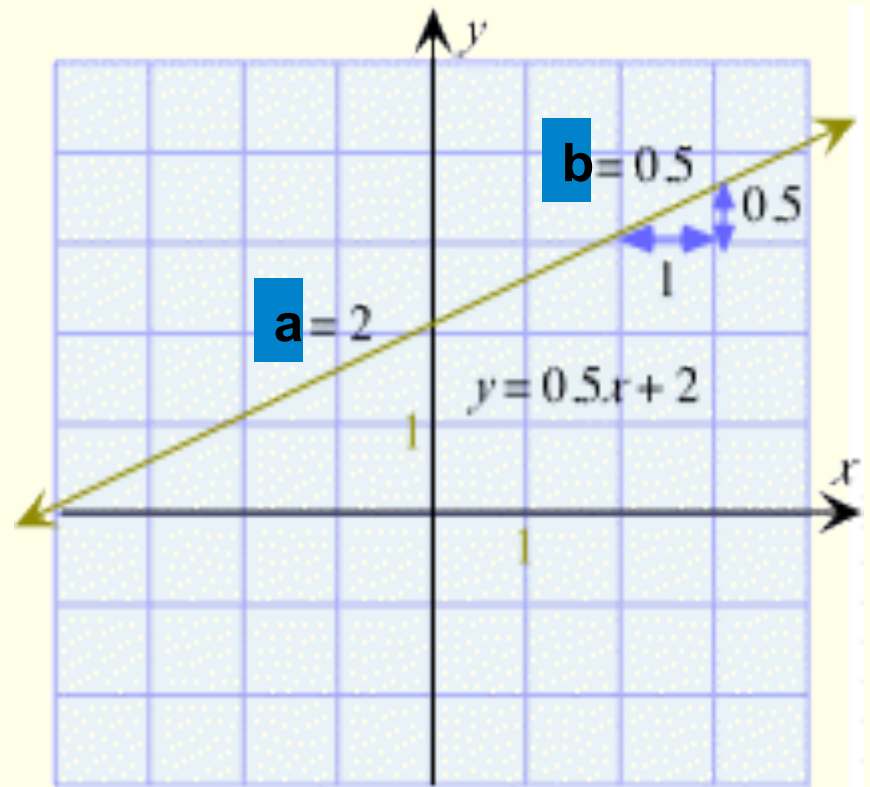
- ✓  $Y = a + b_1X_1 + b_2X_2 + b_3X_3 + \dots$

- ✓  $R$        $R^2$       beta

# Intercept and Slope

## ✓ Simple Regression

- ✓  $Y = a + bX$ , where
- ✓  $a$  = intercept
- ✓  $b$  = slope
- ✓  $\beta$  = beta weight



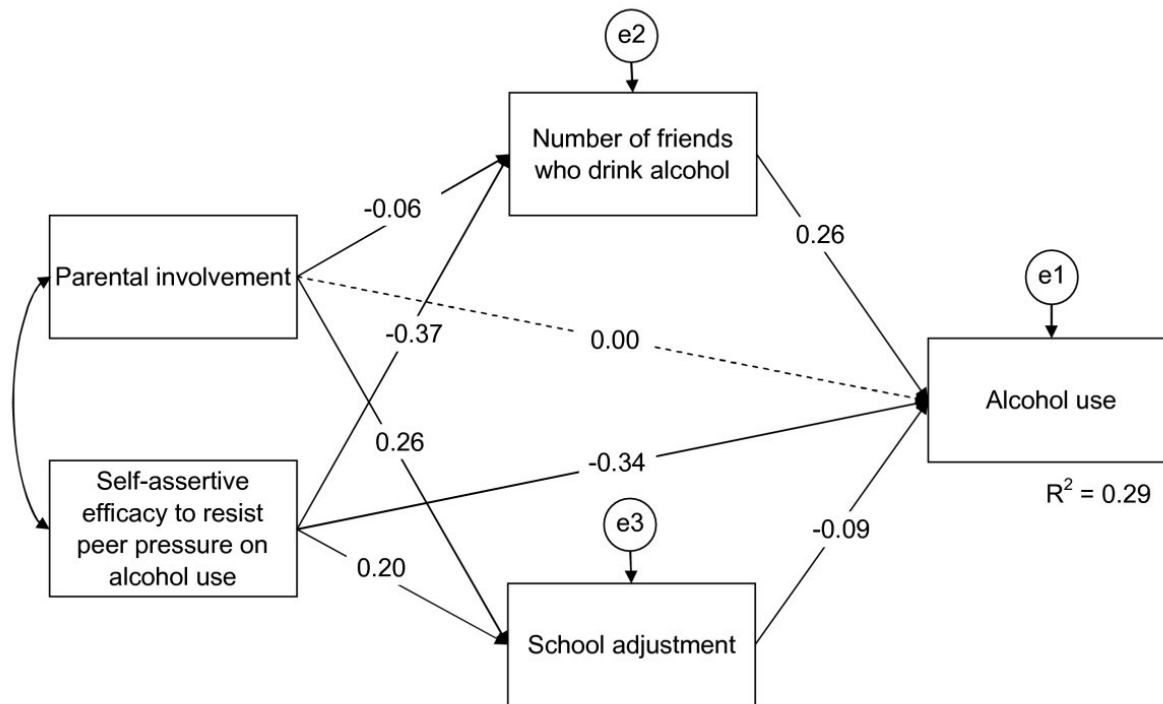
# Multiple Variables w/in a single group

---

- ✓ Types of Regression
  - ✓ Stepwise hierarchical regression
    - ✓ Can determine which variables best predict outcome
  - ✓ Factor analysis
    - ✓ data reduction
  - ✓ Discriminant analysis
    - ✓ How well do variables predict clinical vs. normal s's
  - ✓ Structural Equation Modeling
    - ✓ Weights, path coefficients
    - ✓ Path analysis

# Multiple Variables w/in a single group

(also see pg. 262 Cozby)



# Know your way around a results section

---

- ✓ Dependent variable
- ✓ Independent variable
- ✓ Type of statistical test
- ✓ Report test statistic and descriptive stats

$$X^2(2, n = 200) = 282.66, p < .01$$

$$r = -.64, n = 45, p < .05$$

$$t(48) = 3.58, p < .05$$

$$F(2,298) = 20.45, p < .01$$

# Resources

---

- ✓ [www.statsoft.com](http://www.statsoft.com)
  - ✓ Statistic online Statistics Textbook
- ✓ [www.google.com](http://www.google.com) + any statistical term
- ✓ Andy Fields
  - ✓ Books
  - ✓ Youtube